

# Accuracy Characteristics for Final Delivery Scenario Hours 1600-2100 Single Site

## 1 Introduction

This document contains scenario characteristics for hours 1600 to 2100 GMT recorded on May 26, 1999 at Memphis ARTCC and cover either the ZME or ZID airspace. Characteristics to be provided are general statistics determined from the scenario on airspace characteristics, aircraft to aircraft and aircraft to airspace encounters, general air traffic, aircraft, flight plan adherence, interfacility traffic flow and deviations in weather forecasts. Definitions of the provided scenario characteristics are provided in Reference[1].

## 2 Reference

[1] Paglione, M., Oaks, R., Ryan, Dr. H., Summerill, J.S., (Final, January 2000), *Description of Accuracy Scenarios for the Acceptance Testing of the User Request Evaluation Tool (URET) / Core Capability Limited Deployment (CCLD)*, FAA William J. Hughes Technical Center / ACT-250, Atlantic City, New Jersey.

NOTE – Section numbers in this document do not map to those of the reference document.

## 3 Center Airspace

This section corresponds to Section 3.1 of Reference[1]. The below data corresponds to the ZME Center using the May 20, 1999 ACES chart cycle. Information gathered from running URET PRE, accessing the ZME Center Internet site and local knowledge.

Metric	Definitions	Count
Center Area	Approximate Square Miles	120000
Airports	From URET DU Adaptation List	778
Sectors	From URET DU Adaptation List	110
SAA	Special Activities Airspace	57
APDIA	Automated Problem Detection Inhibited Area	20
SID	Standard Instrument Departure	11
STAR	Standard Arrival Route	10
PAR	Preferential Arrival Route	594
PDR	Preferential Departure Route	346
PDAR	Preferential Departure Arrival Route	124

## 4 Aircraft Encounter Distributions

The statistics collected in this section characterize aircraft to aircraft encounters. The encounter counts are partitioned by selected minimum horizontal separation intervals, a count of encounters partitioned by standard flight levels, and by vertical phase of flight and aircraft encounter angle. This section corresponds to Section 3.2.1 in Reference[1].

### 4.1 Count Partitioned by Minimum Horizontal Separation

This section corresponds to Section 3.2.1.1 in Reference[1].

**Table 1: Count of Current Plan Aircraft Encounters**

Min. Horz. Separation (nm)	Without Adherence	13 Minutes Adherence
$0 \leq d < 5$	175	108
$5 \leq d < 10$	194	113
$10 \leq d < 15$	242	151
$15 \leq d < 23$	542	323
$23 \leq d < 30$	454	259
Total	1607	954

**Table 2: Count of Trial Plan Aircraft Encounters**

Min. Horz. Separation (nm)	Without Adherence	20 minutes Adherence
$0 \leq d < 5$	175	99
$5 \leq d < 10$	194	108
$10 \leq d < 15$	242	140
$15 \leq d < 24$	618	345
$24 \leq d < 30$	378	210
Total	1607	902

## 4.2 Count Partitioned by Altitude for Standard Separation Intervals

This section corresponds to Section 3.2.1.2 of Reference[1].

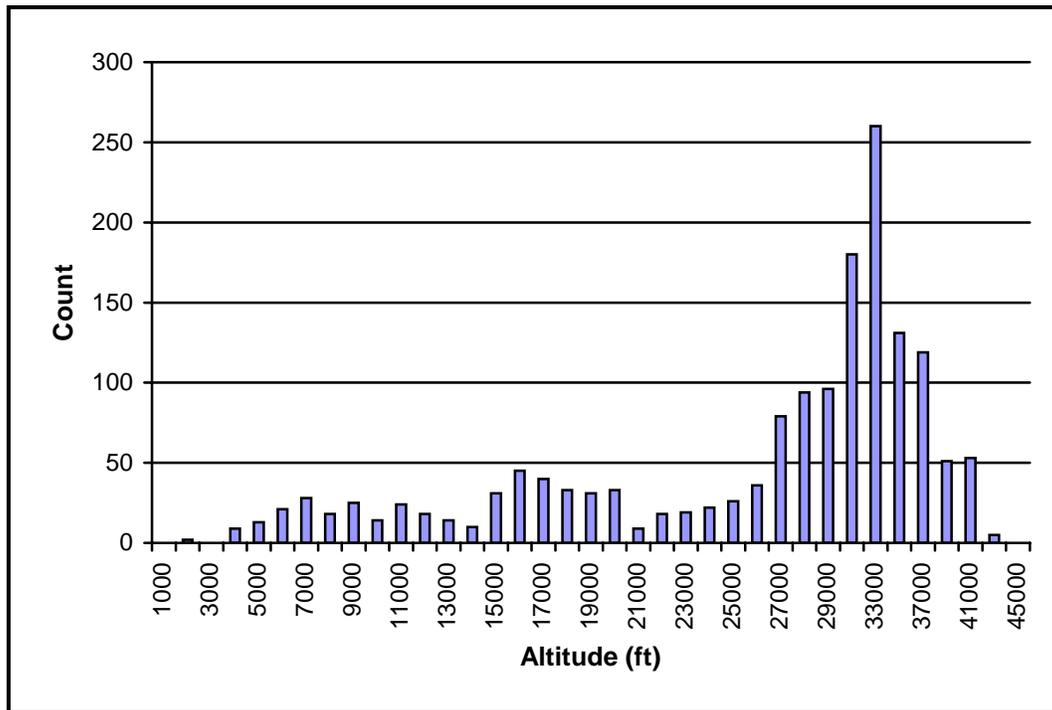


Figure 1: Aircraft to Aircraft Encounters by Altitude

## 4.3 Count Partitioned by Vertical Phase of Flight and Encounter Angle

This section corresponds to Section 3.2.1.3 of Reference[1].

Table 3: Count of Aircraft Encounters Partitioned by Phase of Flight and Encounter Angle

Vertical Phase	Encounter Angles (deg)				Total
	[0, 45)	[45, 90)	[90, 135)	[135, 180]	
Cruise-Cruise	104	115	49	40	308
Descend-Descend	37	12	8	12	69
Climb-Climb	39	5	5	8	57
Cruise-Climb	181	102	98	135	516
Cruise-Descend	172	100	99	143	514
Climb-Descend	54	11	16	35	116
Unknown	15	6	2	4	27
Total	602	351	277	377	1607

## 5 Airspace Encounter Distributions

This section provides statistics on aircraft to airspace encounters. Three areas considered are counts partitioned by selected minimum horizontal separation intervals, an encounter count partitioned by standard flight levels, and a count partitioned by vertical phase of flight and airspace encounter angle. Additionally, vertical phase of flight count is separated into top, bottom and side airspace encounters and for encounters with unknown encounter angles. The section corresponds to Section 3.2.2 of Reference[1].

### 5.1 Count Partitioned by Minimum Horizontal Separation

The section corresponds to Section 3.2.2.1 of Reference[1].

**Table 4: Count of Current Plan Airspace Encounters by Horizontal Separation**

Min. Horz. Separation (nm)	Without Adherence	13 minutes Adherence
Conflicts <sup>1</sup>	2315	1977
$d = 0^2$	37	32
$0 < d < 7$	911	741
$7 \leq d < 9$	238	180
$9 \leq d < 11$	250	182
$11 \leq d < 16$	566	452
$16 \leq d < 30$	1903	1529
Total	6220	5093

**Table 5: Count of Trial Plan Airspace Encounters by Horizontal Separation**

Min. Horz. Separation (nm)	Without Adherence	20 minutes Adherence
Conflicts <sup>3</sup>	2315	1927
$d = 0^4$	37	31
$0 < d < 8$	1024	813
$8 \leq d < 11$	375	276
$11 \leq d < 13$	211	160
$13 \leq d < 19$	764	612
$19 \leq d < 30$	1494	1143
Total	6220	4962

<sup>1</sup> This count includes encounters that are conflicts. By definition the minimum horizontal separation is zero and the track point actually penetrates the airspace.

<sup>2</sup> This count includes encounters without valid airspace penetrations, which occurs under two cases: a short duration penetration or an encounter on the actual buffered boundary of the airspace which does not penetrate.

<sup>3</sup> This count includes encounters that are conflicts. By definition the minimum horizontal separation is zero and the track point actually penetrates the airspace.

<sup>4</sup> This count includes encounters without valid airspace penetrations, which occurs under two cases: a short duration penetration or an encounter on the actual buffered boundary of the airspace which does not penetrate.

## 5.2 Count Partitioned by Altitude

This section corresponds to Section 3.2.2.2 of Reference[1].

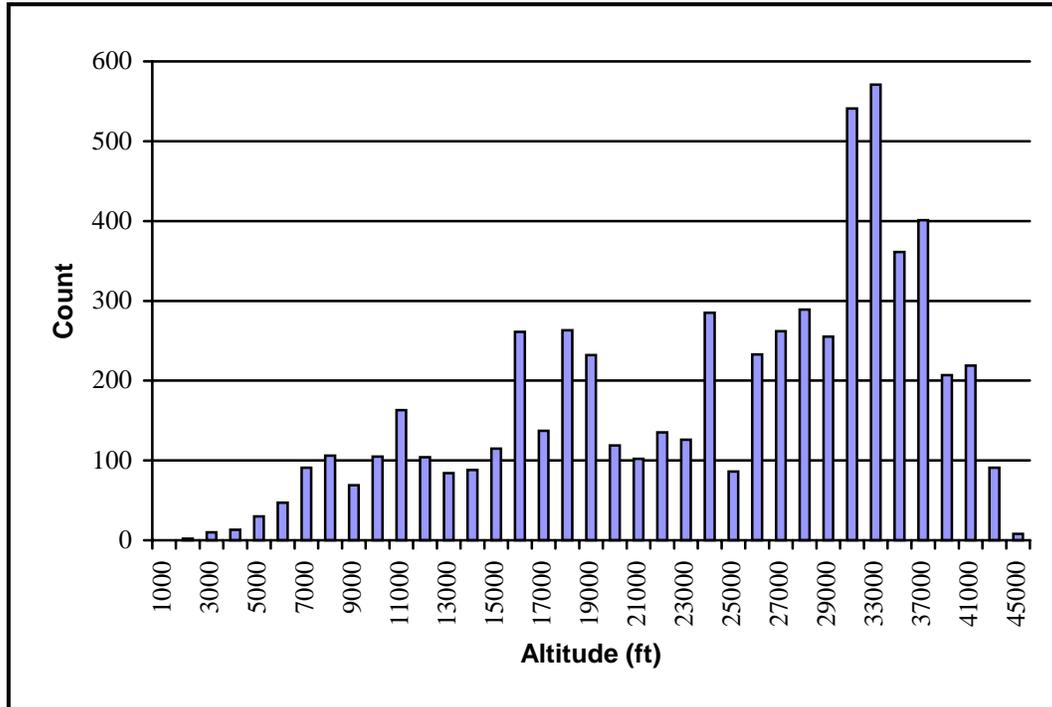


Figure 2: Airspace to Airspace Encounters by Altitude

## 5.3 Count by Vertical Phase of Flight and Encounter Angle

This section corresponds to Section 3.2.2.3 in Reference[1].

Table 6: Count of Airspace Encounters by Angle and Vertical Phase of Flight for Side Conflicts

Vertical Phase	Encounter Angles (deg)			Total
	[0, 30)	[30, 60)	[60, 90)	
Climb	11	58	133	202
Cruise	211	537	811	1559
Descend	21	53	63	137
Total	243	648	1007	1898

**Table 7: Count of Airspace Encounters by Angle and Vertical Phase of Flight for Top and Bottom Conflicts**

Vertical Phase	Encounter Angles (deg)			Total
	[0, 30)	[30, 60)	[60, 90)	
Climb	161	0	0	161
Cruise	4	0	0	4
Descend	18	0	0	18
Total	183	0	0	183

**Table 8: Count of Airspace Encounters by Vertical Phase of Flight with Unknown Angles**

Vertical Phase	Count
Climb	48
Cruise	159
Descend	27
Total	234

## 6 Air Traffic Distributions

This section provides metrics that characterize the air traffic. The metrics are flight density partitioned by standard flight levels, flight type and sector penetration, statistics on the number of active flights, ground speed statistics, counts of interim altitude and amendment messages, and air traffic maneuvers by altitude and phase of flight. This section corresponds to Section 3.3 of Reference[1].

### 6.1 Air Traffic Density

This section corresponds to section 3.3.1 of Reference[1]. Detailed statistics on aircraft encounters are provided in Appendix A.

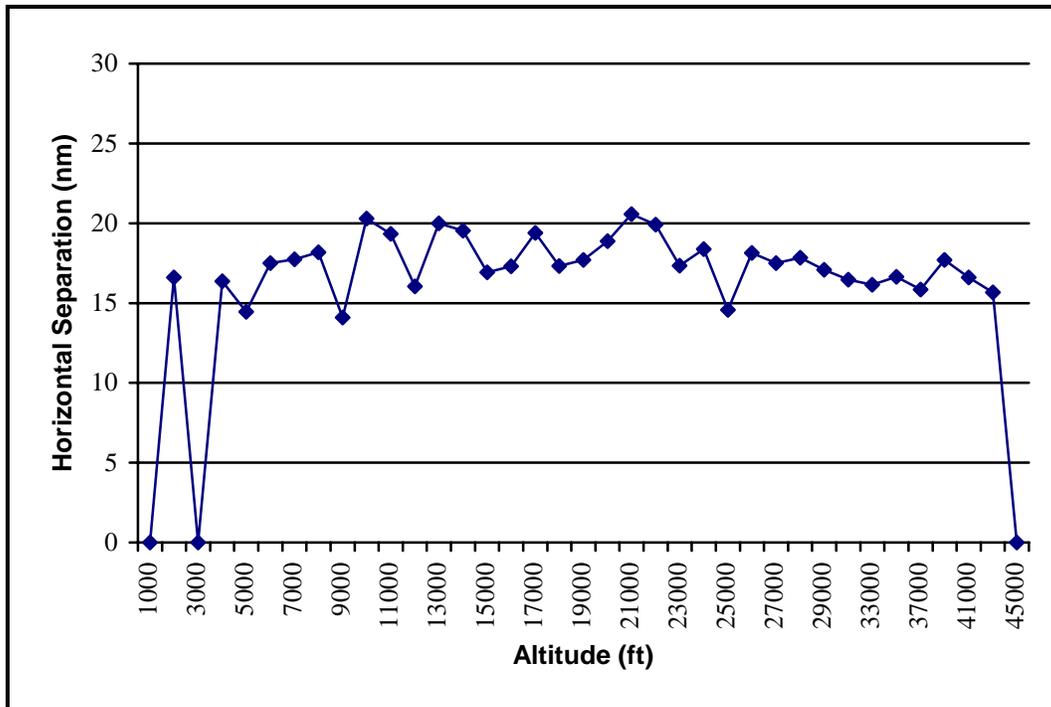


Figure 3: Average Horizontal Separation by Altitude for All Hours

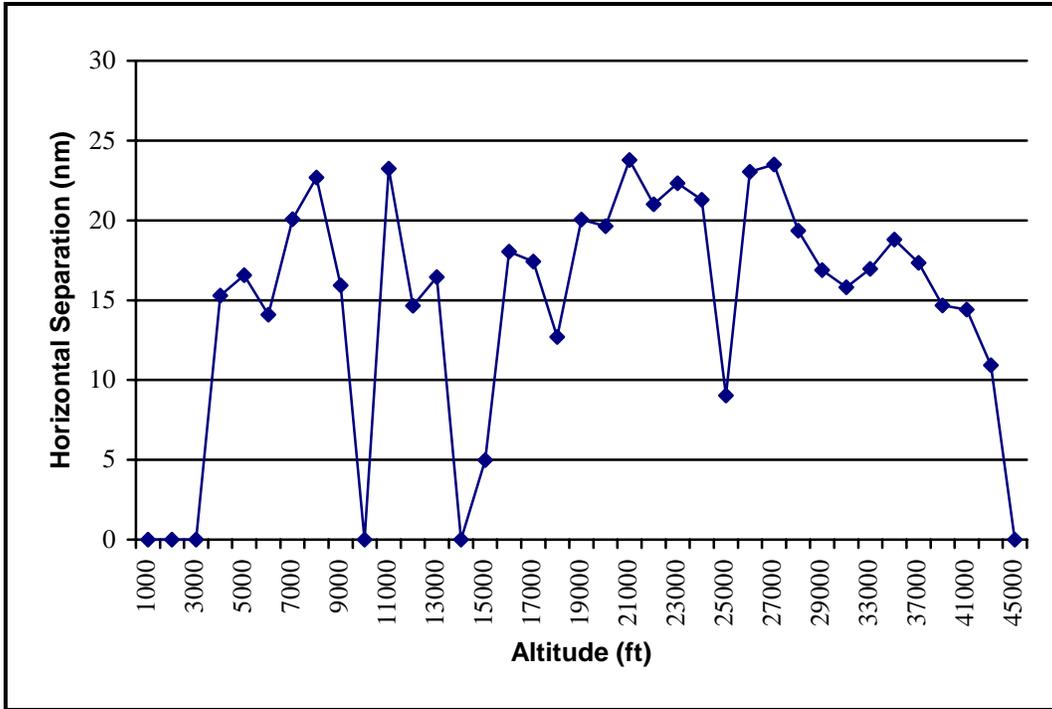


Figure 4: Average Horizontal Separation by Altitude for Hour 1

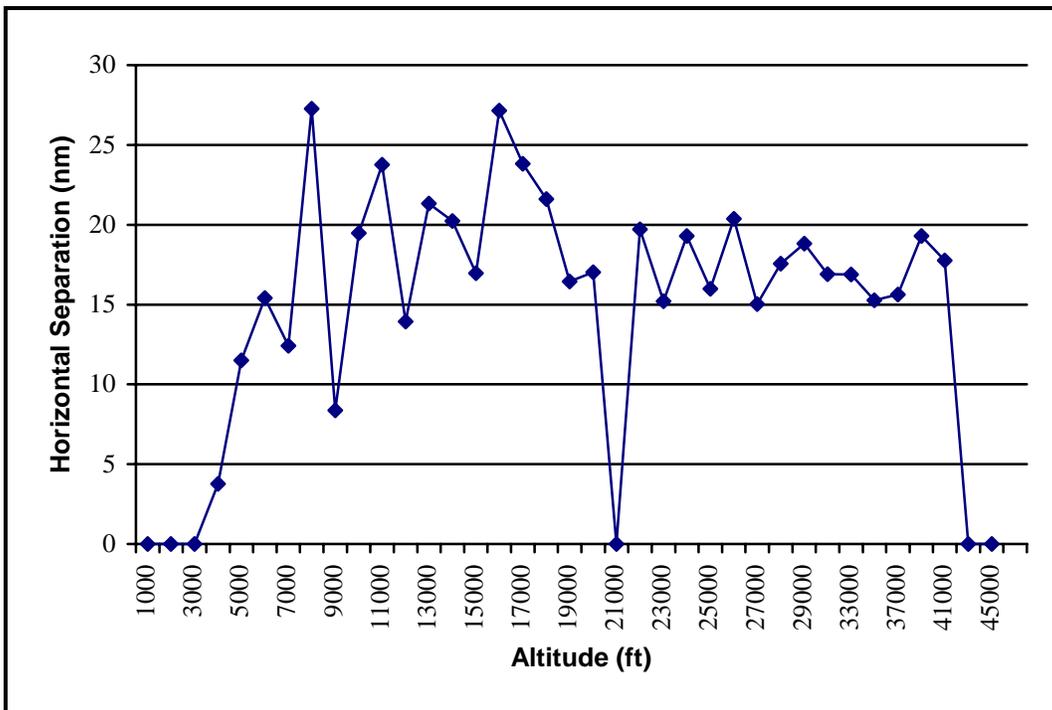


Figure 5 Average Horizontal Separation by Altitude for Hour 2

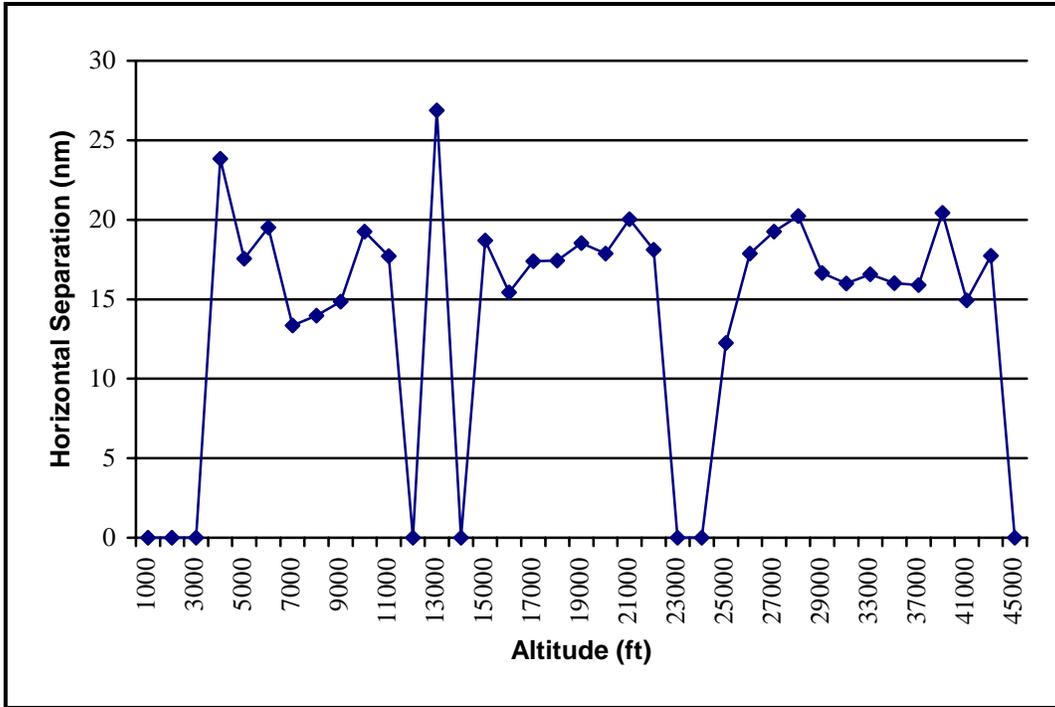


Figure 6 Average Horizontal Separation by Altitude for Hour 3

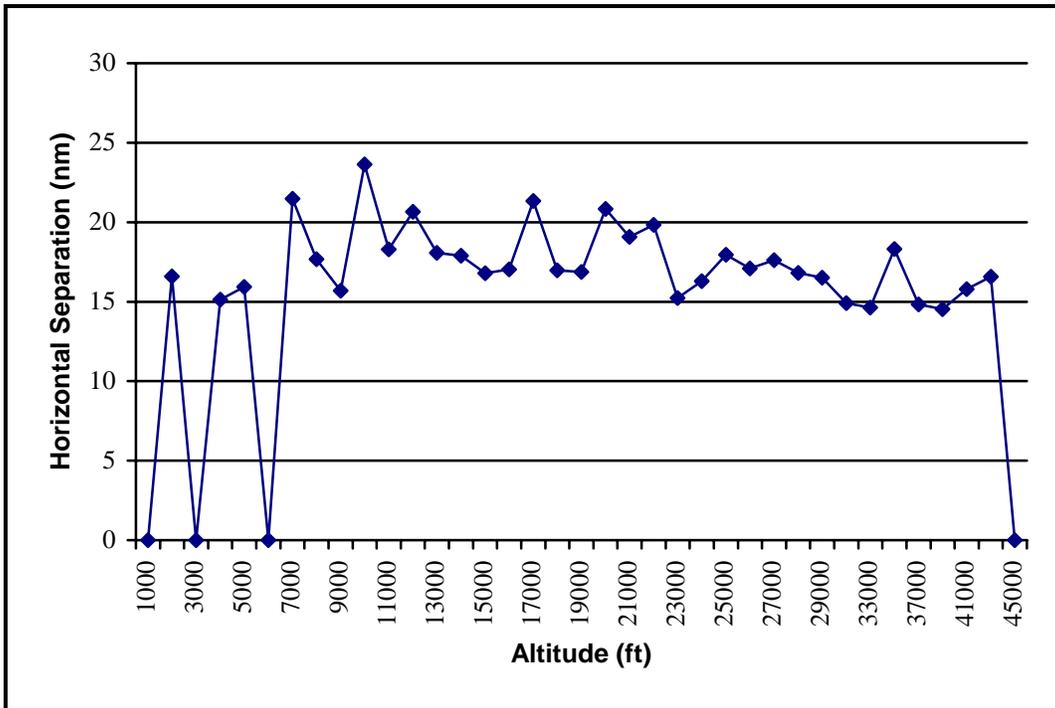


Figure 7: Average Horizontal Separation by Altitude for Hour 4

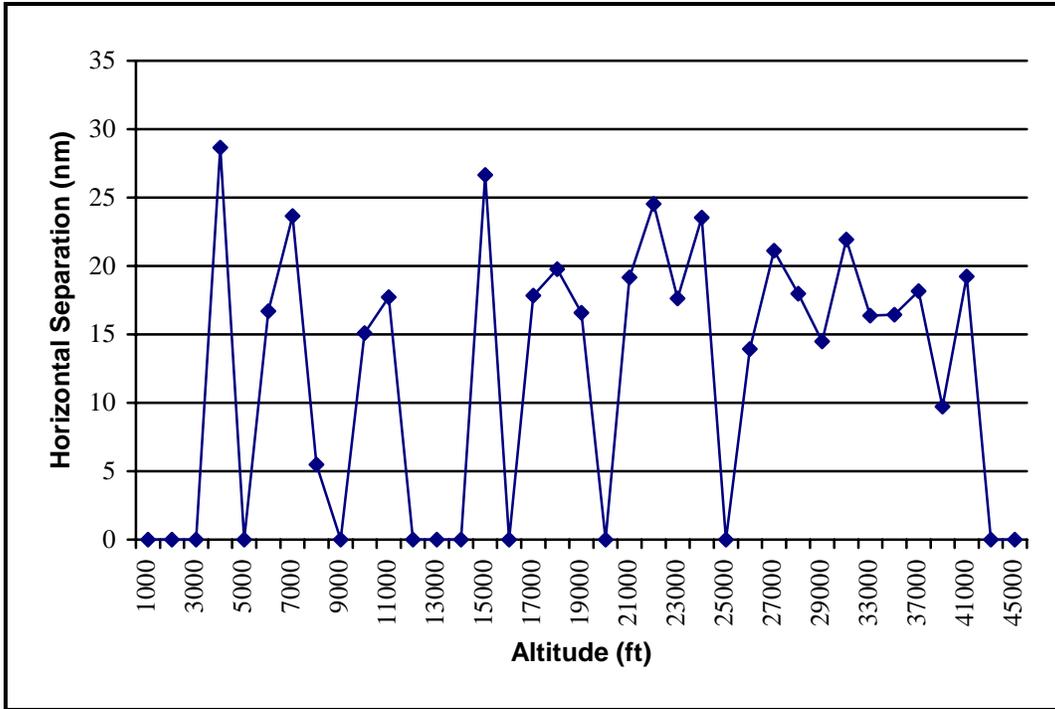


Figure 8: Average Horizontal Separation by Altitude for Hour 5

## Appendix A: Supplement to Section 6.1 - Aircraft Traffic Density

**Table 9: Statistics on Aircraft Encounters by Altitude Interval for All Hours**

Upper Altitude (ft)	Aircraft Count	Avg. Horz. Sep.(nm)	Standard Dev.(nm)
1000	0	0.000	0.000
2000	2	16.601	16.020
3000	0	0.000	0.000
4000	9	16.375	8.192
5000	13	14.448	9.204
6000	21	17.497	8.172
7000	28	17.746	9.326
8000	18	18.170	8.834
9000	25	14.100	8.716
10000	14	20.288	7.797
11000	24	19.326	6.103
12000	18	16.046	8.695
13000	14	19.984	7.586
14000	10	19.533	9.108
15000	31	16.932	8.652
16000	45	17.303	8.233
17000	40	19.400	7.242
18000	33	17.314	7.939
19000	31	17.701	8.821
20000	33	18.885	6.193
21000	9	20.564	5.003
22000	18	19.908	6.745
23000	19	17.339	7.061
24000	22	18.380	6.725
25000	26	14.580	8.528
26000	36	18.141	6.651
27000	79	17.511	7.873
28000	94	17.849	8.019
29000	96	17.076	7.401
31000	180	16.460	8.326
33000	260	16.148	8.402
35000	131	16.654	8.426
37000	119	15.844	8.225
39000	51	17.704	8.030
41000	53	16.600	8.373
43000	5	15.669	4.622
45000	0	0.000	0.000
<b>Total</b>	<b>1607</b>		

**Table 10: Statistics on Aircraft Encounters by Altitude for Hour 1**

Upper Altitude (ft)	Aircraft Count	Avg. Horz. Sep.(nm)	Standard Dev.(nm)
1000	0	0.000	0.000
2000	0	0.000	0.000
3000	0	0.000	0.000
4000	2	15.289	5.073
5000	2	16.563	11.568
6000	2	14.098	16.092
7000	4	20.064	9.265
8000	6	22.676	5.873
9000	8	15.933	6.767
10000	0	0.000	0.000
11000	3	23.252	2.315
12000	6	14.655	7.486
13000	3	16.440	6.437
14000	0	0.000	0.000
15000	3	4.979	6.674
16000	11	18.031	8.398
17000	4	17.413	11.897
18000	5	12.699	8.255
19000	4	20.046	5.632
20000	6	19.637	5.273
21000	2	23.787	0.703
22000	2	21.009	6.898
23000	5	22.335	4.687
24000	1	21.292	0.000
25000	4	9.037	6.888
26000	2	23.039	7.764
27000	2	23.511	0.764
28000	7	19.353	6.242
29000	15	16.876	8.626
31000	34	15.817	7.647
33000	32	16.963	9.058
35000	19	18.789	7.318
37000	11	17.339	8.570
39000	3	14.667	12.012
41000	5	14.410	3.899
43000	1	10.919	0.000
45000	0	0.000	0.000
Total	214		

**Table 11: Statistics on Aircraft Encounters by Altitude for Hour 2**

Upper Altitude (ft)	Aircraft Count	Avg. Horz. Sep.(nm)	Standard Dev.(nm)
1000	0	0.000	0.000
2000	0	0.000	0.000
3000	0	0.000	0.000
4000	1	3.772	0.000
5000	5	11.505	10.890
6000	7	15.418	5.999
7000	6	12.426	9.052
8000	2	27.276	0.849
9000	5	8.367	7.505
10000	4	19.467	6.214
11000	3	23.756	4.894
12000	7	13.941	7.191
13000	7	21.337	7.533
14000	7	20.235	10.593
15000	3	16.970	0.298
16000	2	27.140	1.497
17000	2	23.813	2.839
18000	5	21.606	4.972
19000	8	16.452	10.351
20000	8	17.032	8.048
21000	0	0.000	0.000
22000	5	19.719	8.640
23000	10	15.205	7.996
24000	4	19.301	6.619
25000	9	15.977	10.626
26000	6	20.370	4.537
27000	26	15.034	8.767
28000	30	17.556	8.324
29000	22	18.813	6.525
31000	48	16.903	8.381
33000	47	16.876	8.779
35000	35	15.274	7.851
37000	42	15.627	8.042
39000	27	19.295	7.820
41000	20	17.770	7.578
43000	0	0.000	0.000
45000	0	0.000	0.000
Total	413		

**Table 12: Statistics on Aircraft Encounters by Altitude for Hour 3**

Upper Altitude (ft)	Aircraft Count	Avg. Horz. Sep.(nm)	Standard Dev.(nm)
1000	0	0.000	0.000
2000	0	0.000	0.000
3000	0	0.000	0.000
4000	1	23.843	0.000
5000	1	17.552	0.000
6000	11	19.509	8.731
7000	6	13.340	8.352
8000	1	13.966	0.000
9000	6	14.845	11.514
10000	3	19.259	6.625
11000	8	17.702	7.904
12000	0	0.000	0.000
13000	1	26.881	0.000
14000	0	0.000	0.000
15000	5	18.698	7.713
16000	12	15.432	8.772
17000	16	17.394	7.155
18000	8	17.441	9.201
19000	10	18.536	10.751
20000	9	17.862	5.663
21000	4	20.041	6.923
22000	3	18.116	1.773
23000	0	0.000	0.000
24000	0	0.000	0.000
25000	6	12.249	4.186
26000	12	17.879	6.568
27000	16	19.261	7.219
28000	15	20.228	8.792
29000	27	16.658	8.198
31000	37	15.996	8.228
33000	81	16.569	8.836
35000	43	16.006	9.335
37000	37	15.894	8.609
39000	8	20.440	4.867
41000	4	14.938	13.023
43000	1	17.731	0.000
45000	0	0.000	0.000
Total	392		

**Table 13: Statistics on Aircraft Encounters by Altitude for Hour 4**

Upper Altitude (ft)	Aircraft Count	Avg. Horz. Sep.(nm)	Standard Dev.(nm)
1000	0	0.000	0.000
2000	2	16.601	16.020
3000	0	0.000	0.000
4000	4	15.133	6.765
5000	5	15.924	9.161
6000	0	0.000	0.000
7000	10	21.474	9.373
8000	6	17.674	7.469
9000	6	15.686	8.998
10000	5	23.645	5.852
11000	7	18.288	5.829
12000	5	20.661	11.681
13000	3	18.072	10.387
14000	3	17.894	5.560
15000	17	16.799	8.567
16000	20	17.041	7.900
17000	17	21.328	6.423
18000	13	16.981	7.919
19000	8	16.876	7.566
20000	10	20.839	5.772
21000	2	19.082	5.268
22000	7	19.836	8.033
23000	2	15.227	1.552
24000	13	16.284	7.071
25000	7	17.948	8.491
26000	15	17.085	7.548
27000	29	17.606	7.765
28000	37	16.820	7.843
29000	29	16.520	6.919
31000	45	14.912	8.584
33000	67	14.630	7.921
35000	23	18.305	8.295
37000	23	14.838	8.660
39000	10	14.523	9.011
41000	20	15.784	9.005
43000	3	16.566	5.303
45000	0	0.000	0.000
Total	473		

**Table 14: Statistics on Aircraft Encounters by Altitude for Hour 5**

Upper Altitude (ft)	Aircraft Count	Avg. Horz. Sep.(nm)	Standard Dev.(nm)
1000	0	0.000	0.000
2000	0	0.000	0.000
3000	0	0.000	0.000
4000	1	28.649	0.000
5000	0	0.000	0.000
6000	1	16.707	0.000
7000	2	23.648	5.034
8000	3	5.481	6.504
9000	0	0.000	0.000
10000	2	15.084	18.256
11000	3	17.721	2.768
12000	0	0.000	0.000
13000	0	0.000	0.000
14000	0	0.000	0.000
15000	3	26.658	2.826
16000	0	0.000	0.000
17000	1	17.837	0.000
18000	2	19.777	9.388
19000	1	16.575	0.000
20000	0	0.000	0.000
21000	1	19.169	0.000
22000	1	24.532	0.000
23000	2	17.632	7.224
24000	4	23.540	3.777
25000	0	0.000	0.000
26000	1	13.937	0.000
27000	6	21.114	4.097
28000	5	17.974	8.638
29000	3	14.497	6.326
31000	16	21.930	7.655
33000	33	16.365	7.050
35000	11	16.435	8.734
37000	6	18.174	6.273
39000	3	9.730	0.780
41000	4	19.225	10.656
43000	0	0.000	0.000
45000	0	0.000	0.000
Total	115		